X-rays and Protostars in the Trifid Nebula

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The Trifid Nebula is a young HII region recently rediscovered as a "pre-Orion" star forming region, containing protostars undergoing violent mass ejections visible in optical jets as seen in images from the Infrared Space Observatory and the Hubble Space Telescope. We report the first X-ray observations of the Trifid nebula using ROSAT and ASCA. The ROSAT image shows a dozen X-ray sources, with the brightest X-ray source being the O7 star, HD 164492, which provides most of the ionization in the nebula. We also identify 85 T Tauri star and young, massive star candidates from near-infrared colors using the JHK_s color-color diagram from the Two Micron All Sky Survey (2MASS). Ten X-ray sources have counterpart near-infrared sources. The 2MASS stars and X-ray sources suggest there are potentially numerous protostars in the young HII region of the Trifid. ASCA moderate resolution spectroscopy of the brightest source shows hard emission up to 10 keV with a clearly detected Fe K line. The best model fit is a two-temperature ($T = 2.0 \times 10^6$ K and 36×10^6 K) thermal model with additional warm absorbing media. The hotter component has an unusually high temperature for either an O star or an HII region; a typical Galactic HII region could not be the primary source for such hot temperature plasma and the Fe XXV line emission. We suggest that the hot component originates in either the interaction of the wind with another object (a companion star or a dense region of the nebula) or from flares from deeply embedded young stars.

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